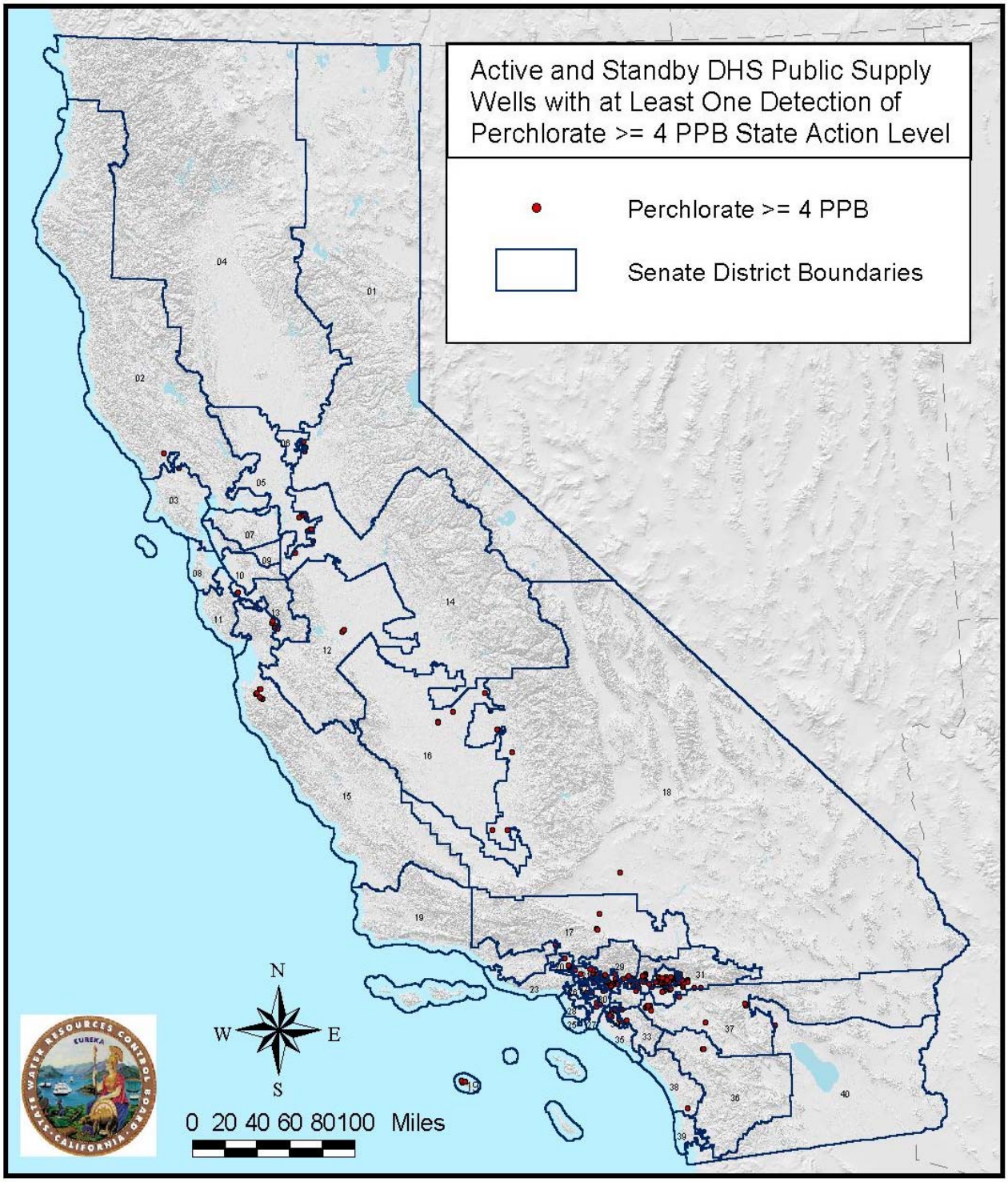
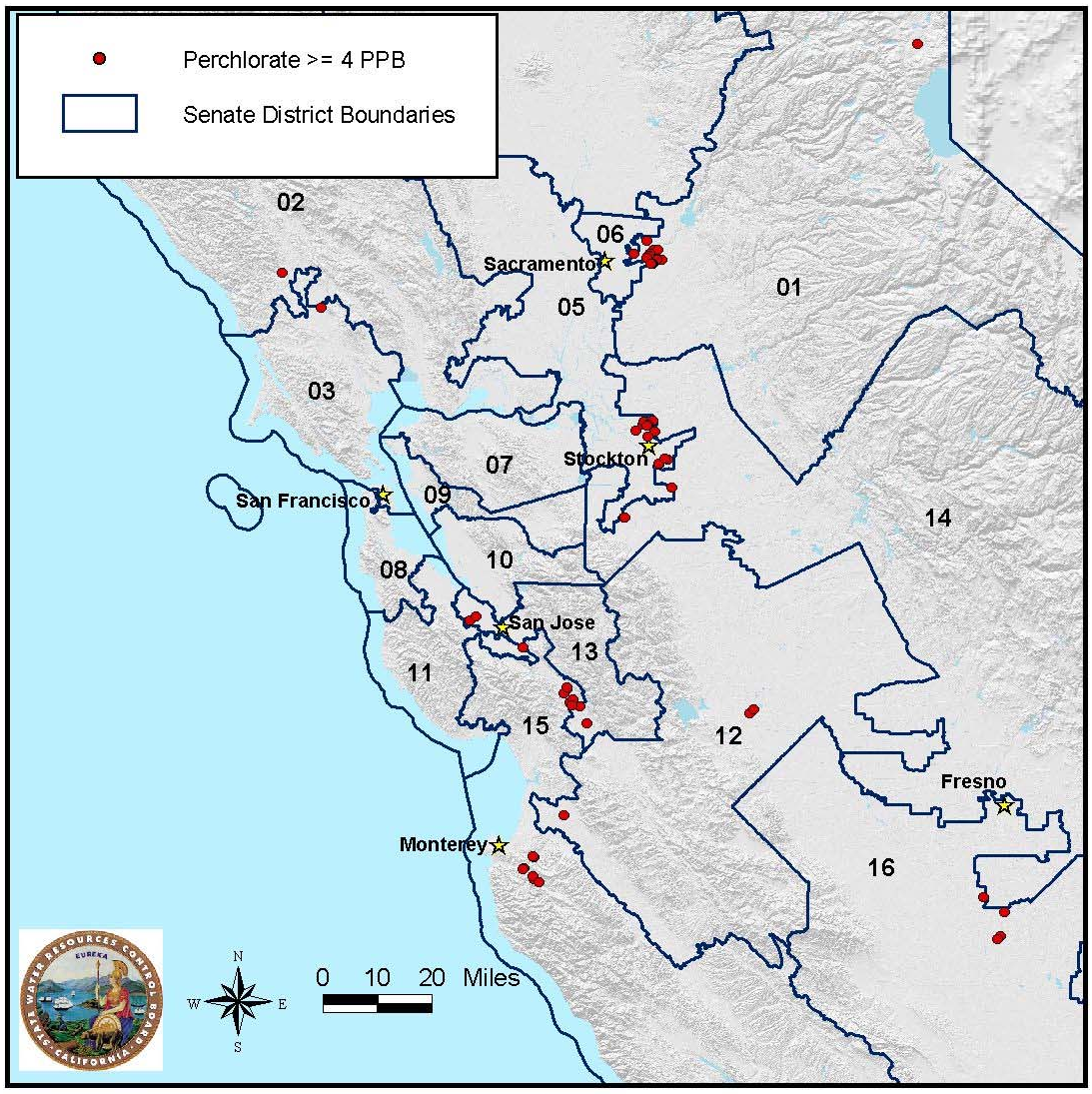
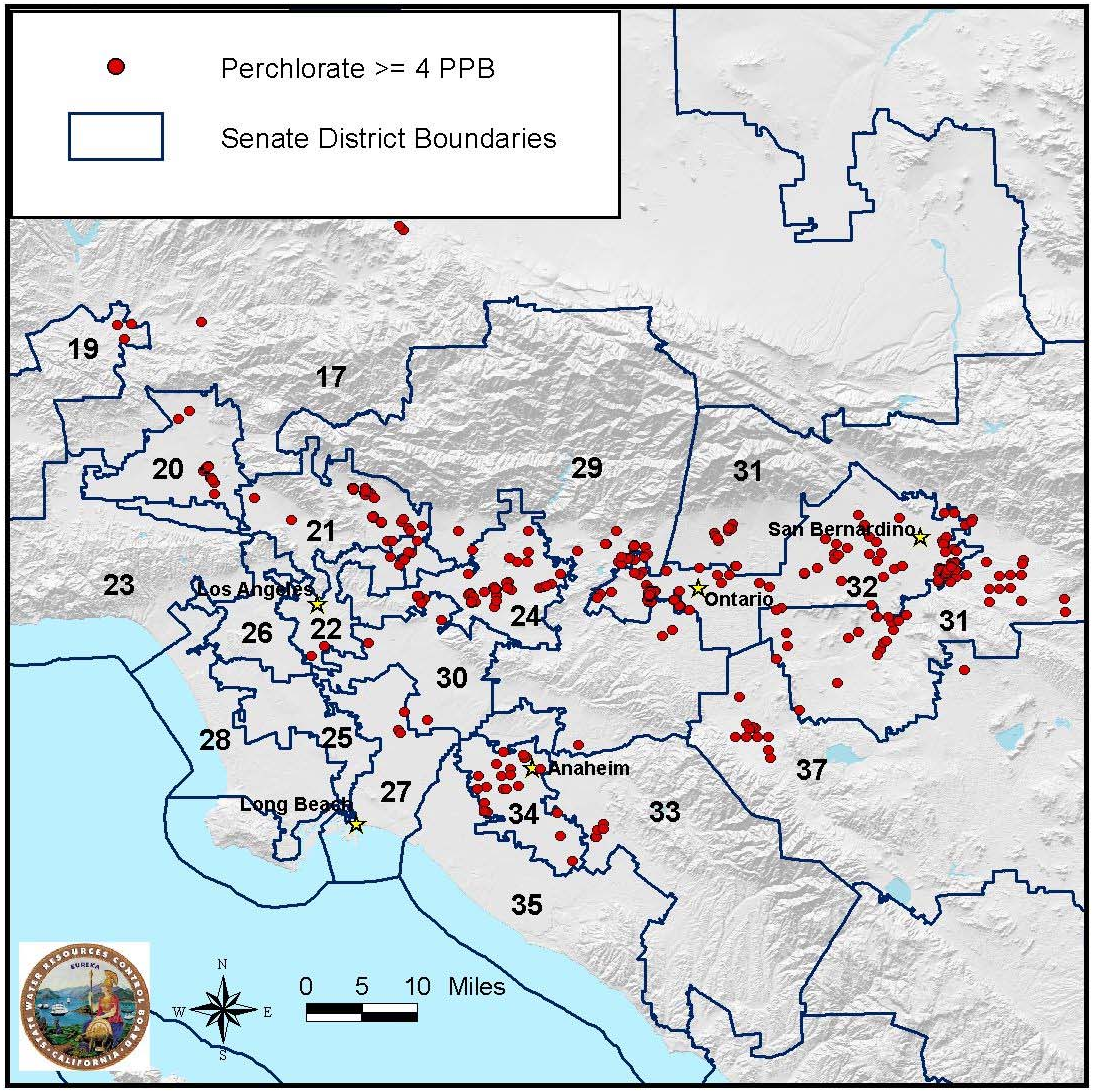
Appendix A: Perchlorate Detection by Senate District*



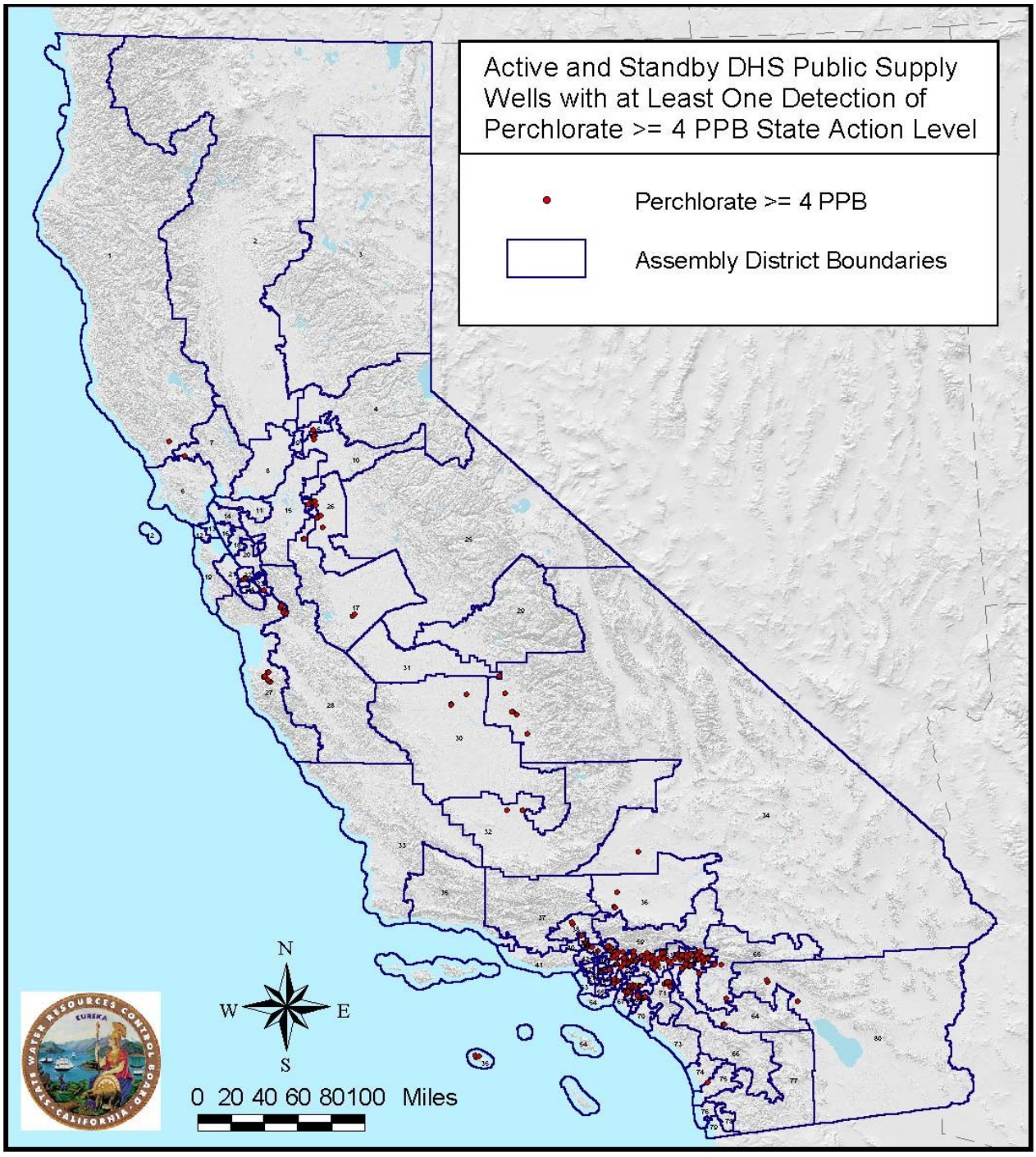
From SWRCB.

* Note: This map shows only perchlorate detections at well sites, which does not include detections associated with other water supplies, such as the Colorado River.


Perchlorate >= 4 PPB
Senate District Boundaries
02
06
Sacramento
01
05
03
07
Stockton
09
San Francisco
14
10
08
San Jose
13
11
15
12
Fresno
Monterey
16
N
W
E
S
0 10 20 Miles

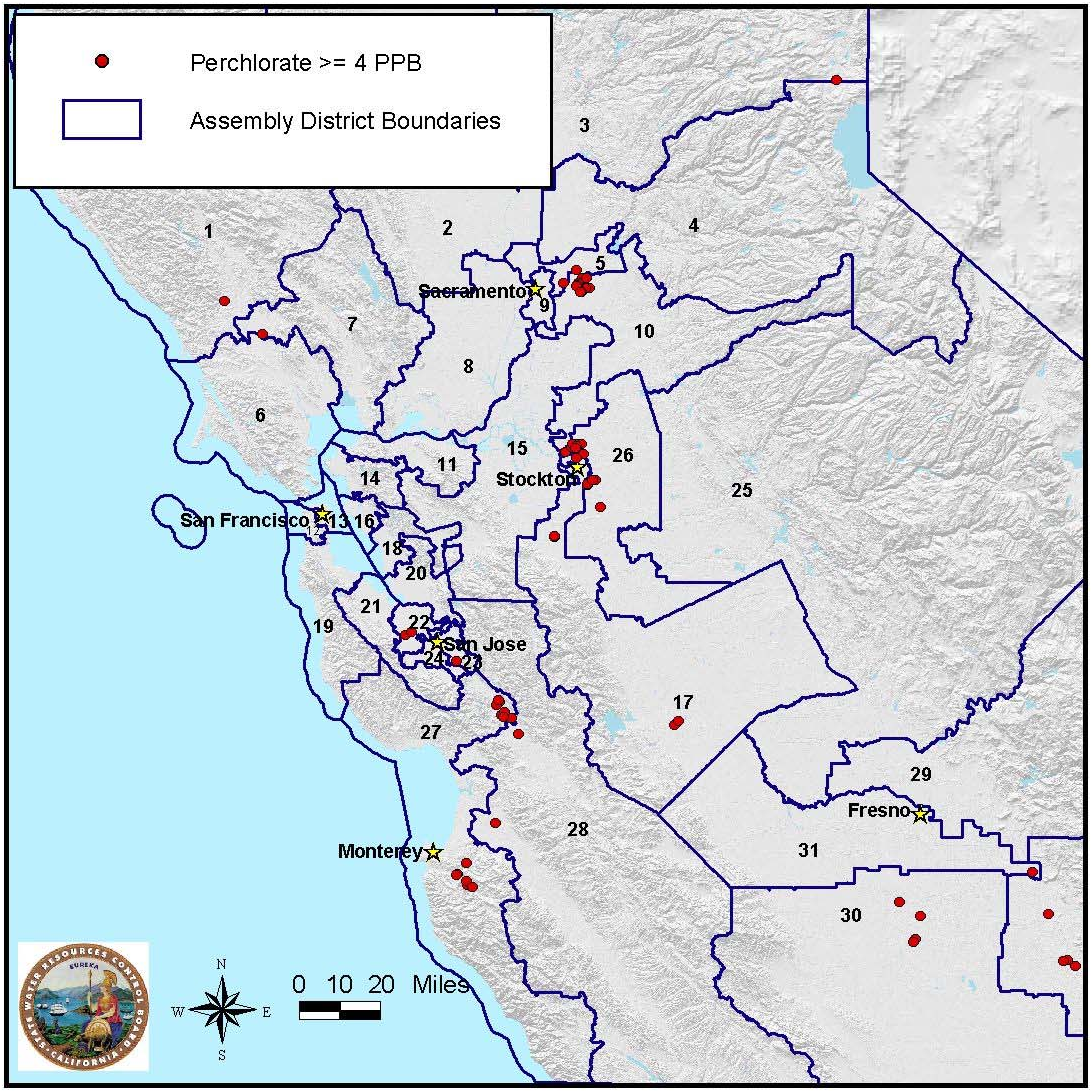

Perchlorate >= 4 PPB
Senate District Boundaries
19
17
20
29
31
21
San Bernardino
23
Los Angeles
Ontario
32
24
31
26
22
30
28
25
Anaheim
37
27
Long Beach
34
33
35
N
W
E
S
0 5 10 Miles

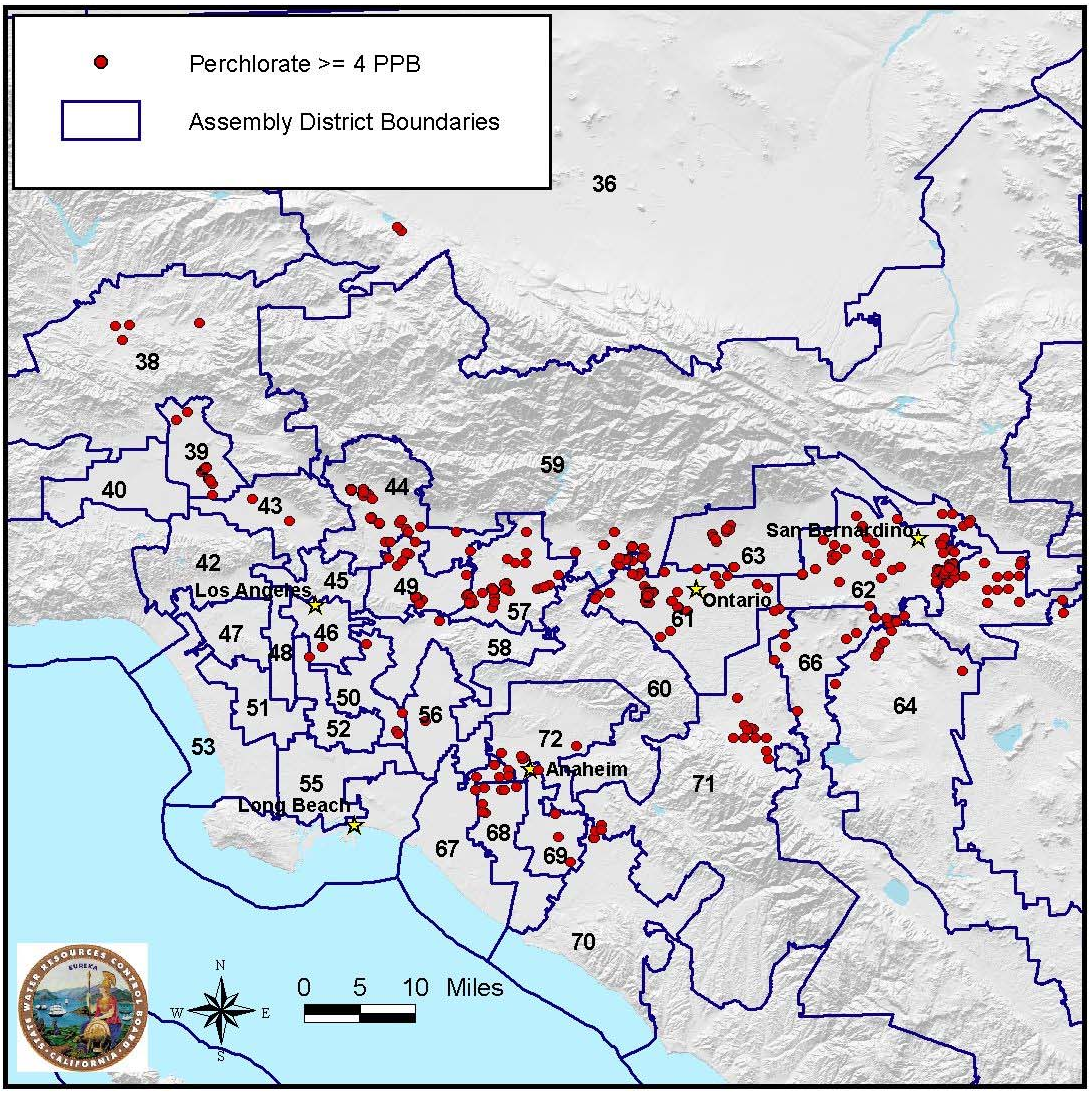
Appendix B: Perchlorate Detection by Assembly District*



From SWRCB.

* Note: This map shows only perchlorate detections at well sites, which does not include detections associated with other water supplies, such as the Colorado River.


Perchlorate >= 4 PPB
Assembly District Boundaries
1
2
3
4
5
6
7
8
9
10
11
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
Sacramento
Stockton
San Francisco
San Jose
Fresno
Monterey
N
W
E
S
0 10 20 Miles


Perchlorate >= 4 PPB
Assembly District Boundaries
36
38
39
40
43
44
59
42
Los Angeles
45
49
57
47
46
48
58
San Bernardino
63
Ontario
61
62
66
64
60
51
50
52
56
53
72
Anaheim
71
55
Long Beach
68
67
69
70
N
W
E
S
0 5 10 Miles

Appendix C-1: How Much Perchlorate is Too Much?

Below is a quick reference summary of the concentration levels associated with various state and federal agency evaluations of perchlorate.

Issuing Agency	Evaluation	Level
U.S. EPA	Groundwater cleanup guidance level (1992,1995 & 1999)	4 -18 ppb
CA OEHHA*	CA Public Health Goal (2002)	2 – 6 ppb
CA DHS	CA Action Level (2002)	4 ppb
U.S. EPA	Draft risk assessment (2002)	1 ppb
CA DHS	CA MCL (2004)	???

*Office of Environmental Health Hazard Assessment

Appendix C-2: How Do Other States Assess Perchlorate?

Listed below are the detection levels required by some other states before issuing advisories or taking actions to address perchlorate.[1]

State	Level
Arizona	14 ppb
Maryland	1 ppb
Massachusetts	1 ppb
Nevada	18 ppb
New Mexico	1 ppb
New York	5 -18 ppb
Texas	4 ppb

[1] Data in table compiled from EPA website: http://www.epa.gov/swerffrr/documents/perchlorate.htm; and from presentation by: Kevin Mayer, U.S. EPA, Region 9. "The Nature of Perchlorate and the National Occurrence of Perchlorate." June 4, 2002.

California Water Resources Control Board

Insert RB Letterhead

XXXXXXXX, 2003

Addressee
Facility Address,
City, State, Zip Code

Dear _____:

REQUEST FOR A TECHNICAL REPORT ON EMERGENT CHEMICALS SOURCES AND SAMPLING, FACILITY NAME AND ADDRESS

The California Regional Water Quality Control Board ("Regional Board") is the public agency with primary responsibility to protect groundwater and surface water quality within this Region. This Regional Board requests your assistance in identifying potential sources of emergent chemicals, {perchlorate, n-nitrosodimethylamine (NDMA), 1,4-dioxane, 1,2,3-trichloropropane, chromium VI, and polybrominated diphenyl ether (PBDE)}, in soil, groundwater or surface water. Our priority in this regard is assessing the groundwater quality associated with former and active military facilities for the presence of emergent chemicals of concern. We are requesting you submit a Source Evaluation Report, identifying sources of emergent chemicals at all areas of concern (AOC), installation restoration (IR) and operable unit (OU) sites within the facility.

SUMMARY

The detection of emergent chemicals in groundwater, above State and Federal maximum contaminant levels (MCLs) or action levels (ALs) have recently caused this Regional Board to reassess the threat posed to groundwater resources used for domestic and municipal supply. Furthermore, many drinking water supply wells have been shut down throughout California due to pollution from one or more of these emergent chemicals. These recent developments have raised concerns about losing beneficial uses of groundwater due to the presence of these chemicals in soil, surface water, or groundwater. Enclosed is a California Environmental Protection Agency (CalEPA) letter expressing these concerns, and a request for cooperation on addressing these concerns.

The presence of these emergent chemicals can increase the costs of effective remediation and has caused the reassessing of cleanup remedies. All of these emergent chemicals have acute to chronic health effects in humans even though some have been found at very low concentrations, i.e. nanograms/Liter (parts per trillion (ppt)). In addition, some of these chemicals are suspected carcinogens. The enclosure to this letter provides additional emergent chemical information.

Based upon our knowledge of military facilities, we believe that sources for emergent chemicals potentially exist at former or active military facilities, which can date back to the early 1940s. Facilities that have taken a proactive approach and already evaluated source areas, and collected data on the emergent chemicals, should respond to the following request by verifying the agencies have the information.

DIRECTIVES

We are requesting your assistance in identifying sources of emergent chemicals at all AOC, IR and OU sites within the facility for Department of Toxic Substances Control (DTSC) and Regional Board review, regardless of which agency is lead for the facility. The intent of our request is to increase efficiency by reducing the need for similar requests in the future. These AOC, IR, and OU, sites should include, but are not limited to:

Potential Source Areas for Emergent Chemicals Associated with Explosives

- Ordnance detonation/disposal sites,
- Missile/rocket test sites and launch pads,
- Catch basins, waste sumps, clarifiers, and settling ponds,
- Decommissioned missile silos,
- Suspected areas where chemicals and pesticides were stored, used, transferred, processed, incinerated, or disposed,
- Firing and bombing ranges, and
- Mock battle training locations.

Potential Source Areas for Emergent Chemicals Associated with Solvent Release Sites

- Catch basins, waste sumps, clarifiers, and settling ponds,
- Paint maintenance, hobby shops, plating shops, and degreasing activities,
- Weapons maintenance or cleaning areas,
- Known release sites, as appropriate, and
- Suspected areas where these chemicals and pesticides were stored, used, transferred, processed, incinerated, or disposed.

In order to assist us in identifying potential sources of emergent chemicals we are asking that a Source Evaluation Report be prepared. Please prepare and submit a Source Evaluation Report for Regional Board and/or DTSC review, by **XXXXXX XX, 2003.** At a minimum, the source evaluation report should include the following:

1. Property ownership and land use history from original land grant,
2. Locations where emergent chemicals were used and stored on-site,
3. Location and time specific quantities of emergent chemicals used, if available,
4. Handling and storage procedures for the use of emergent chemicals and emergent chemical wastes used and/or generated on site,
5. Emergent chemical data from soil, surface water, and groundwater already collected, and
6. Schedule for when environmental samples will be collected at sites with no existing soil, surface water and groundwater data on emergent chemicals.

Facilities completing the evaluation of sources for the emergent chemicals finding no potential sources should also report the results of the evaluation.

Due to the prevalence of these chemicals in groundwater, all sites with groundwater pump and treat systems should sample the influent to the systems, regardless of whether an identified potential source exists.

Following review of the source evaluation report there will be a determination made by Board and/or DTSC staff if a proposal for collecting emergent chemical data for soil, surface water and groundwater is necessary. If it is determined that a sampling proposal is required, the sampling proposal should include the following:

1. Locations, numbers, and identity of proposed wells, surface water locations, and treatment systems to be sampled,
2. The rationale for sampling these selected wells,
3. Proposed soil sampling locations and rationale,
4. A brief description of the methodology proposed to be used to collect the soil and/or water samples, and
5. A schedule for sampling these soils, surface waters and wells.

Samples should be collected as described in a Board and/or DTSC approved sampling proposal. Ideally, at those sites with potential sources, selected groundwater monitoring wells and surface water locations should be sampled during the next scheduled monitoring event for the emergent chemicals and the results transmitted to the agencies in the next groundwater monitoring report for the facility.

TESTING REQUIREMENTS

Listed below are the emergent chemicals of concern and our recommendations with respect to acceptable testing procedures for each of the specified emergent chemicals:

Emergent Chemical	Acceptable Test Method[2]	Reporting Limit
Perchlorate	USEPA Method 314.0	4 µg/L
N-Nitrosodimethylamine (NDMA)	USEPA Method 1625	0.002 µg/L
1,4-Dioxane	USEPA Method 8270	2 µg/L
1,2,3-Trichloropropane	USEPA Method 524.2	0.005 µg/L
Total/Hexavalent Chromium	USEPA Method 200.8/218.6	1 µg/L/0.3 µg/L
Polybrominated Diphenyl Ether	USEPA Method 8270	2 µg/L

[2] These test methods may require modification, e.g. selected ion monitoring, to achieve the recommended reporting limits.

The use of these analytical testing procedures by a California Certified Laboratory will provide consistency in the analysis of environmental samples and high quality data necessary to make appropriate regulatory decisions.

If you have any questions, please contact _____ at (XXX) ### - ####.

Sincerely,

Executive Officer

Enclosures:
1. CalEPA Letter Dated June 6, 2003
2. Emergent Chemical Information

cc: State Water Resources Control Board, Office of Chief Counsel, Regional Board Attorney
California Department of Toxic Substances Control, Facility Project Manager
California Department of Toxic Substances Control, Mr. Tony Landis (N. CA)
California Department of Toxic Substances Control, Mr. John Scandura (S. CA)
Ms. Vera Melynk-Vecchio, California Department of Health Services
Ms. Elizabeth Adams, USEPA, Superfund Division, Region IX, San Francisco
Mr. Kevin Mayer, USEPA, Superfund Division, Region IX, San Francisco

ENCLOSURE 1

Winston H. Hickox
Agency Secretary
Cal/EPA

State of California
California Environmental Protection Agency

Gray Davis
Governor

Air Resources Board | Department of Pesticide Regulation | Department of Toxic Substances Control
Integrated Waste Management Board | Office of Environmental Health Hazard Assessment | State Water Resources Control Board | Regional Water Quality Control Board

June 6, 2003

Mr. John Paul Woodley, Jr.
Assistant Deputy Under Secretary
of Defense for Environment
Department of Defense
3400 Defense Pentagon
Washington, D.C. 20301-3400

Dear Mr. Woodley:

We are writing to seek the cooperation of the Department of Defense (DoD) in addressing perchlorate contamination at DoD's active, closed, and historic military and contractor facilities in California on behalf of my office, the California Environmental Protection Agency (Cal/EPA) and Cal/EPA's Department of Toxic Substances Control (DTSC) and State Water Resources Control Board (SWRCB). The potential sources of perchlorate contamination include facilities that manufacture, conduct research on, and use solid propellants for rockets, missiles, military ordnance, and pyrotechnics. Military and defense contractor facilities are among the known and suspected sources of contamination of this type.

We cannot overstate the seriousness of this problem for the State of California. To date, perchlorate has been detected in more than 300 wells, including public water supply wells. The loss of drinking water supply wells to perchlorate contamination may leave parts of California without sufficient water for the summer months. In response to this crisis, the California Legislature is expressing its interest in finding the sources and solutions to these impacts to the State's water by holding hearings on the matter.

Our efforts to address perchlorate contamination in California warrant a collaborative approach to this environmental crisis. Together, we need to identify sources of perchlorate contamination, coordinate research of treatment strategies and technologies, and eventually clean up both impacted drinking water and water used for other beneficial uses.

Cal/EPA and its constituent boards and departments need to extend this coordinated approach to DoD to address perchlotate and other emerging chemicals of concern emanating from military properties. To that end, the Regional Water Quality Control Boards have coordinated with the SWRCB in preparing a letter to military installations in California requesting assistance in identifying, investigating, and cleaning up sources of

1001 I Street | Sacramento, CA 95814
phone: 916.445.3846 | fax: 916.445.6401
www.calepa.ca.gov

perchlorate and other chemicals of concern on their properties. We have enclosed a copy of this draft letter for your information.

We ask that you direct the installations and appropriate program managers in DoD to assist and cooperate in this effort. In addition, we understand that DoD conducted a national survey of perchlorate contamination on military facilities, and we would request the opportunity to review the results of this survey for installations in California.

Both DTSC and SWQCB representatives are available to meet with you or your staff to further discuss this issue. Should you have any questions or need further assistance, please contact Mr. Frederick S. Moss, Chief, Office of Military Facilities, DTSC, at (916) 255-3750 or Ms. Lisa Babcock, Chief, Land Disposal Section, SWRCB, at (916) 341-5687.

Sincerely,

Winston H. Hickox
Agency Secretary

Edwin F. Lowry
Director
Department of Toxic Substances Control

Celeste Cantú
Executive Officer
State Water Resources Control Board

Enclosures

cc: See next page.

Perchlorate (ClO_4-) originates as a contaminant in the environment from the inorganic salts of ammonium, potassium, magnesium or sodium perchlorate. This pollutant is exceedingly mobile in aquifer systems. It can persist for many decades under typical groundwater and surface water conditions, because of its resistance to react with other available constituents. Perchlorate is among a group of unregulated chemicals requiring monitoring pursuant to Title 22, California Code of Regulations § 64450. The California Department of Health Services (DHS) action level for Perchlorate is 4 μg/L

N-Nitrosodimethylamine, is also known as NDMA ($C_2H_6N_2O$), a product from the decomposition of unsymmetrical dimethyl hydrazine, a component used in the production of rocket fuel (Aerozine 50). This chemical is used as an additive in liquid propellant fuel for rocket engines. NDMA is used primarily in research (NTP, 2000), but it can also be formed inadvertently in a number of industrial processes. NDMA is identified as a carcinogen under California's Health and Safety Code Section 25249.5, *et seq*., and the Safe Drinking Water and Toxic Enforcement Act of 1986 ("Proposition 65"). In addition, the USEPA identifies NDMA as a "probable human carcinogen" (USEPA, 1997). The California (DHS) action level for NDMA is 10 ng/L.

1,4-Dioxane is used as a stabilizer for chlorinated solvents or volatile organic compounds (VOCs), particularly 1,1,1-trichloroethane approximately 90% of the 1,4-dioxane produced. Releases of chlorinated solvents or VOCs may be a primary source of 1,4-dioxane in the environment. 1,4-dioxane has a high potential for entering the environment due to its volatility and solubility in water. Spent chlorinated solvents disposed of improperly can contaminate ground and surface water, and 1,4-dioxane has been detected in surface waters throughout the United States. Exposure to small amounts of 1,4-dioxane may lead to significant adverse health effects. The primary routes of exposure include inhalation, ingestion and dermal contact. USEPA has classified 1,4-dioxane as a Group B2, probable human carcinogen of low carcinogenic hazard. The California (DHS) action level for 1,4-Dioxane 2 μg/L.

1,2,3-Trichloropropane (TCP): This chemical has been used primarily as a solvent and extractive agent. As a solvent, it has commonly been used as a paint and varnish remover, a cleaning and degreasing agent and a cleaning and maintenance solvent. TCP is not a naturally occurring chemical. Releases to the environment are likely to occur as a result of its manufacture, formulation, and use as a solvent and extractive agent, paint and varnish remover, cleaning and degreasing agent, cleaning and maintenance reagent, and chemical intermediate. TCP is also used as a pesticide in the formulations with dichloropropenes in the manufacture of D-D, a soil fumigant. 1,2,3-Trichloropropane (TCP) is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of malignant tumor formation at multiple sites in multiple species of experimental animals. The California (DHS) action level for 1,2,3 TCP is 0.005 μg/L.

Hexavalent Chromium: This chemical is a dissolved heavy metal that is or has been used in industrial processes, such as metal plating and as a corrosion inhibitor in cooling tower water. Chromium VI is a known human carcinogen. Chromium VI detection in drinking water wells has resulted in well closures. There is no Federal or State regulatory standard for chromium VI. However, California Senate Bill 351 proposes to have one in place starting January 1, 2004. For now, the regulatory standards being used apply only to total chromium, the combined concentrations of chromium III and chromium VI. The risk-based California drinking water standard or maximum contaminant level (MCL) of 50 μg/L has been established for total chromium (chromium III and chromium VI).

Polybrominated Diphenyl Ether (PBDE): A family of flame-retardants used in polyurethane foam, textiles, and plastic electronic casings. This chemical bioaccumulates in marine mammals, birds, and humans. No actions levels are currently available.

Appendix E: Perchlorate Chronology

1940s	Large-scale manufacture of perchlorate begins in the United States.
1950s to present	Perchlorate widely used by defense and aerospace industries, primarily as component in solid rocket fuel. Vast amounts of perchlorate are routinely "washed" from rocket engines and replaced. Much perchlorate is released into the environment due to disposal procedures.
1952	Perchlorate's effect on thyroid function first discovered.
1960s	Perchlorate used to treat patients with Grave's disease to correct overactive thyroids. Severe, occasionally fatal side effects result. The practice is discontinued.
1992	U.S. EPA develops a provisional "reference dose" (RfD) for perchlorate at which level even a daily dose will cause no deleterious effects over a lifetime. The RfD for perchlorate is equivalent to a drinking water concentration level of between 4 and 18 parts per billion (ppb).
February 1997	DHS finds perchlorate contamination in drinking water wells at levels as high as 260 ppb* at Aerojet site east of Sacramento. Discovery prompts establishment of a state action level for perchlorate of 18 ppb (in agreement with the high-end of the U.S. EPA's RfD).
March 1997	California Department of Health Services (DHS) develops a method for detecting perchlorate in concentrations as low as 4 ppb.
April 1997	DHS conducts tests of drinking water wells in Los Angeles County and detects perchlorate concentrations as high as 159 ppb associated with several possible industrial polluters in Asuza, Santa Clarita, and Pasadena.

* Higher concentrations (100,000 ppb) are detected in water that had been treated for other contaminants and then re-injected into the ground.

Also in 1997	The Metropolitan Water District of Southern California discovers perchlorate in the lower Colorado River. The source is determined to be the Kerr-McGee manufacturing plant in Henderson, Nevada (just outside Las Vegas), where tons of perchlorate wastes were dumped into unlined ponds over a period of nearly 25 years. At the time, over 870 pounds of perchlorate were entering Lake Mead each day.
2001	The Department of Defense (DOD) conducts a survey of perchlorate contamination at DOD sites. DOD has not shared results of this survey.
2002	U.S. EPA submits for peer review a revised draft RfD corresponding to a perchlorate concentration of 1 ppb in drinking water.
January 18, 2002	In response to EPA's draft revision, DHS lowers the California action level to 4 ppb (corresponding to the low end of the original EPA RfD).
March 2002	Perchlorate associated with an Olin Corp. site is found in a Morgan Hill well. Less than 18 months later, over 400 wells are found to be impacted. Plume stretches over eight miles and threatens the town of Gilroy.
December 2002	The state Office of Environmental Health Hazard Assessment releases a revised draft perchlorate public health goal of 2 ppb to 6 ppb.
March 2003	The White House Office of Management and Budget refers perchlorate to the National Academy of Sciences (NAS) for a further review of six to 18 months following an extensive peer-review process. Release of EPA's draft risk assessment of perchlorate is delayed. The EPA bans public discussion of perchlorate by its employees until the NAS delivers its opinion.
January 1, 2004	By state statute, DHS must set a maximum contaminant level for perchlorate by the first of the year, 2004.

Website Sources

The following Websites provided a wealth of information on perchlorate, especially given the rapid rate at which new data is becoming available on detections, research, and technology.

United States Environmental Protection Agency (U.S. EPA) Technology Innovation Office: http://www.clu-in.org/

U.S. EPA: http://www.epa.gov/

California Department of Health Services: http://www.dhs.cahwnet.gov/

California Office of Environmental Health Hazard Assessment: http://www.oehha.ca.gov/index.html

California Environmental Protection Agency, State Water Resources Control Board: http://www.swrcb.ca.gov/

Environmental Working Group: http://www.ewg.org/